Field Collection Procedures for Bed-Sediment Samples

Bed sediment (hereafter termed "sediment") samples are collected after any water samples have been collected. Care must be taken not to sample sediments that have been walked on or disturbed in any manner by field personnel collecting water samples. Sediment samples are collected into a composite jar, where they are thoroughly homogenized in the field, and then aliquoted into separate jars for chemical or biological analysis. Sediment samples for metals and organics are submitted to the respective analytical laboratories in separate glass jars, which have been pre-cleaned according to laboratory protocol

Sediment chemistry samples give information regarding both trends in contaminant loading and the potential for adverse effects on sediment and aquatic biota. In order to compare samples over time and from site to site, they must be collected in a consistent manner. If a suitable site for collecting sediments cannot be found at a station, sampling personnel should not collect the sediment sample, and should instead attempt to reschedule the sample collection. If this is not possible, make a note so that the missing sample is accounted for in the reconciliation of monitoring events during preparation of sample collection "cruise reports". Sites that are routinely difficult to collect should be considered for elimination from the sample schedule, if appropriate.

Characteristics of Ideal Sediment Material to be Collected

Many of the chemical constituents of concern are adsorbed onto fine particles. One of the major objectives in selecting a sample site, and in actually collecting the sample while on site, is to obtain recently deposited fine sediment, to the extent possible. Avoid hard clay, bank deposits, gravel, and disturbed and/or filled areas. Any sediment that resists being scooped by a dredge is probably not recently deposited fine sediment material. In following this guidance, the collection of sediment is purposefully being biased for fine materials, which must be discussed thoroughly in any subsequent interpretive reporting of the data, in regards to representativeness of the collected sample to the environment from which it was collected.

Characteristics of an Ideal Site

Quiescent areas are conducive to the settling of finer materials (EPA/USACOE, 1981).

Choose a sampling site with lower hydrologic energy, such as the inner (depositional) side of bends or eddies where the water movement may be slower. Reservoirs and estuaries are generally depositional environments, also.

Field Collection Procedures for Bed-Sediment Samples

Selecting the Appropriate Sediment Type for Analysis

See filename: "FieldSiteEvaluation_and_Recon_guidelines_1202.doc", within Appendix D of this QAMP for more specific guidance.

Sediment will vary from site to site and can vary between sample events at a particular site.

Streams and Rivers: Sediment collection in flowing streams is often a challenge. In areas of frequent scouring there may not be sufficient sediment for collection during or following periods of high flow. Sediment collection during these times may prove unsuccessful and may have to be rescheduled.

When the suspended load in rivers and streams precipitates due to reduction of velocity, most of the resulting sediment will be fine-grained. More often than not, a dredge or mechanical grab device does not function well for collection of sediment in smaller streams. In many cases, sediment will have to be collected using a pre-cleaned Teflon scoop. Collect the top two (2) cm for analysis. Five or more (depending on the volume of sediment needed for conducting analyses) fine-sediment sub-sites within a 100-meter reach are sampled into the composite jar.

Reservoirs and Estuaries: Collect the top two (2) cm for analysis. Five or more grabs are composited for the sediment sample, depending on the volume of sediment needed for conducting analyses.

GENERAL PROCEDURE FOR COLLECTION OF BED SEDIMENT

After choosing an appropriate site, and identifying appropriate fine-grained sediment areas within the general reach, collect the sample using one or more of the following procedures, depending on the setting:

A. Sediment Scoop Method—Primary Method for Wadeable, Shallow Streams

The goal is to collect the top 2cm of recently-deposited fine sediment only .

- Wear gloves and protective gear, per appropriate protocol (make sure gloves are long enough to prevent water from overflowing gloves while submerging scoop).

Field Collection Procedures for Bed-Sediment Samples

- Survey the sampling area for appropriate fine-sediment depositional areas before stepping into the stream, to avoid disturbing possible sediment collection sub-sites.
- Carefully enter the stream and start sampling at the closest appropriate spot, after rinsing the homogenizing jar and lid with ambient water. Then continue sampling UPSTREAM. Never advance downstream, as this could lead to sampling disturbed sediment.
- Use a clean polyethylene scoop for each site (pre-cleaned beforehand in the laboratory, with Micro™ detergent and acid, rinsed, dried and double-bagged). Scoop can be transported from vehicle to site inside the homogenizing jar. Gently lead the scoop under water and towards the sediment. Run scoop slowly underneath sediment at about 2cm depth till about ½ to ¾ filled. Then carefully lift the scoop out of the water and slowly poor off most of the overlying water over one of the BACK corners of the scoop. Make sure that the top layer of fine sediment is not discarded. Fill homogenizing jar as far as necessary to fill all required sample volumes. I-CHEM 4000mL tall clear 300 Series glass jars are used to collect and homogenize sediment samples.
- Cap homogenizing jar, put on ice, and transport to site where sample containers are to be filled.
- Make sure all containers are capped tightly.
- Write date and time on each container label (container bag label for TM [trace metals] and Hg [mercury] prior to aliquoting.
- Single bag all containers (except TM [trace metals] and Hg [mercury] containers – are double bagged already) in zip lock bags.
- Store in cooler on cube ice at 4°C.
- Check cooler temperature and record in log book every 8-12 hours or whenever sampler suspects that the temperature has not been maintained at 4 C.

B. Sediment Grab Method—Primarily for Lake, River, Bridge, and Estuarine Settings (or deeper streams)

Description of sediment grab equipment

- A mechanical sediment grab is used for the SWAMP bed sediment collection field effort for lake, river, bridge, and estuarine/coastal settings (or deeper, non-wadeable streams).
- The mechanical grab is a stainless steel “Young-modified Van Veen Grab", and is 1 square meter in size.
- The mechanical grab is deployed primarily from a boat, and is used in deeper, non-wadeable waters, such as lakes, rivers, estuaries, and coastal areas.
- It is also deployed by field personnel from land in settings which allow its use: primarily from bridges; from smaller vessels in streams or drainage channels too deep or steep to wade into, but too shallow for a larger boat.

Field Collection Procedures for Bed-Sediment Samples

Field Collection Procedures for Bed-Sediment Samples

Deploying and retrieving the grab

- Slowly lower the grab to the bottom with a minimum of substrate disturbance.
- Retrieve the closed dredge at a moderate speed (less than two feet per second).
- Upon retrieval, examine the grab to ensure that the sediment surface is undisturbed and that the grab sample should not be rejected.

Rejection Criteria—reject the sample if the following are not met:
Mud surface must not be pressing out of the top of the sampler. If it is, lower the grab more slowly.

- Overlying water must not be leaking out along the sides of the sediment in the grab. This ensures the surficial sediment is not washed out.
- Sediment surface is flat and level in the sampler. If it is not level, the grab has tilted over before closing.

Processing the sediment sample from the grab equipment:
The water overlying the sediment in the grab is very gently decanted by slightly tipping the grab with the lid closed until the water runs out the top.

- The decanting process should remove all of the overlying water but not remove the surficial sediments. The laboratory reports percent water for the sample, so overlying water is not included in the sample container.
- The sediment is examined for depth of penetration, color and thickness of top aerobic zone, and texture. These observations are recorded in the logbook.
- Collect the top 2 cm from at least five sub samples, and otherwise, exclude the bottom-most layer and composite.
- In streams or other settings with excessive bottom debris (rocks, sticks, leaves) where the use of a grab is determined to be ineffective (dredge does not close, causing loss of sediment), samples may be collected by hand using a clean plastic scoop, or by a variety of coring methods, if appropriate for the situation.
- Sediment is handled as described below in the metals and organic sections.

Cleaning the Grab Equipment and Protection from Potential Contaminating Sources:

- The sediment sampler will be cleaned prior to sampling EACH site by: rinsing all surfaces with ambient water, scrubbing all sediment sample contact surfaces with Micro™ or equivalent detergent, rinsing all surfaces with ambient water, rinsing sediment sample contact surfaces with 5% HCl, and rinsing all sediment sample contact surfaces with methanol.
- The sediment grab will be scrubbed with ambient water between successive deployments at ONE site, in order to remove adhering sediments from contact surfaces possibly originating below the sampled layer, thus preventing contamination from areas beyond target sampling area.
- Sampling procedures will attempt to avoid exhaust from any engine aboard any vessel involved in sample collection. An engine will be turned off when possible during portions of the sampling process where contamination from engine exhaust

Field Collection Procedures for Bed-Sediment Samples

may occur. It is critical that sample contamination be avoided during sample collection. All sampling equipment (i.e., siphon hoses, scoops, containers) will be made of non-contaminating material and will be appropriately cleaned before use. Samples will not be touched with un-gloved fingers. In addition, potential airborne contamination (e.g., from engine exhaust, cigarette smoke) will be avoided.

Sediment Sub-sample Collection Procedure (Removal from Grab): Before sub-samples from the grab sampler are taken, the overlying water will be removed. One method of removing this water is by slowly siphoning it off to pipette out overlying water. Other methods, such as decanting the water or slightly opening the sampler to allow the water to escape, will be done slowly and with care to minimize disturbance or loss of fine-grained surficial sediment. Once the overlying water has been removed, the top 2 cm of surficial sediment can be sub-sampled from the grab. Sub-samples are taken using a pre-cleaned flat bottom scoop. This device allows a relatively large sub-sample to be taken accurately. Because accurate and consistent sub sampling requires practice, a trained and experienced person performs this task. When sub sampling surficial sediments, unrepresentative material (e.g., large stones or vegetative material) will be removed from the sample in the field. The smaller rocks and other small foreign material remain in the sample.

C. Core Method--alternative for fast-moving, wadeable streams

The core method is used in soft sediments when it is difficult to use the other methodologies. The cores can be used in depths of water from 0 to 10 feet by using a pole deployment device or in deeper water using SCUBA divers. The pole deployment device consists of a pole that attaches to the top of the core. The top of the core is fitted with a one-way valve, which allows the core to be filled with sediment, but when pulled from the sediment catches the sediment within the core. The core is then brought to the surface and the sediments within the core are extruded out the top of the core so that 2 cm. of sediment is above the top of the plastic core. The 2 cm of sediment is then sliced off and placed in the homogenizing jar. The core, homogenizing jar, and device used to slice off the top two cm. are all cleaned according to field protocols herein in Appendix D.

GENERAL PROCEDURE FOR PROCESSING OF BED SEDIMENT SAMPLES, ONCE THEY ARE COLLECTED

Sediment Homogenization, Aliquoting and Transport

For the collection of bed sediment samples, the top 2-cm is removed from the scoop, or the grab, or the core, and placed in the 4-liter glass compositing/homogenizing container.

Field Collection Procedures for Bed-Sediment Samples

The composited sediment in the container is homogenized and aliquoted on-site in the field. The sample is stirred with a polycarbonate stirring rod for at least 5 minutes, but longer if necessary, until sediment/mud appears homogeneous. All sample identification information (station numbers, etc.) will be recorded prior to homogenizing and aliquoting.

All pre-labeled jars will be filled using a clean plastic scoop. The sediment sample is then aliquoted into appropriate containers for trace metal chemistry, organic chemistry, and bioassay testing. Four-liter sample containers will be packed surrounded by enough ice to keep them cool for 48 hours. Each container will be sealed in one large plastic bag to prevent contact with other samples or ice or water.

Metals and Semi-volatile Organics in Sediment	For trace metals and semi-volatile organics, a minimum of three grabs is distributed to the composite bottle and/or sample containers. Mixing is generally done with a polycarbonate stirring rod. <u>Collecting Metal, Semi-Volatile, or Pesticide Samples:</u> Make sure the sample volume is adequate, but the containers do not need to be filled to the top. Seal the jars with the Teflon liner in the lid.
Sediment Conventionals	Sediment conventionals are sometimes requested when sediment organics, sediment metals, and/or sediment toxicity tests are requested for analysis of samples. The collection method is the same as that for metals, semi-volatile organics, and pesticides. Sediment conventionals include: grain size analysis and total organic carbon. These are used in the interpretation of metals and organics in sediment data.
Sample Containers	See "Sediment Sample Handling Requirements" Table at end of this document, as well as in Appendix C of this QAMP.
Sediment Sample Size	Must collect sufficient volume of sediment to allow for proper analysis, including possible repeats, as well as any requested archiving of samples for possible later analysis. See "Sediment Sample Handling Requirements" Table at end of this document, as well as in Appendix C of this QAMP.
Labeling	Label the jars with the station ID, sample code, matrix type, project ID, and date of collection, as well as the type of analysis requested (i.e., metals, conventionals, organics, or archives).
Short-term Field Preservation	Immediately place the labeled jar on ice, cool to 4°C, and keep in the dark at 4°C until delivery to the laboratory.
Field Notes	Record the depth at the location where the sample was taken in the field logbook. Record a gross description of the sample, i.e., color, texture, number of grabs, and thickness of grab sample that was composited. This information can be reported as comments with the sediment analytical results. Fill out SWAMP Station Occupation Data Sheet and the Sediment Data Sheet.

Field Collection Procedures for Bed-Sediment Samples

Field Collection Procedures for Bed-Sediment Samples

SUMMARY OF SEDIMENT SAMPLE COLLECTION METHODS, PRESERVATION, STORAGE, AND HANDLING REQUIREMENTS

Parameters for Analysis	Recommended Containers	Typical Sample Volume (ml)	Initial Field Preservation	Maximum Holding Time
Bed Sediment Samples				
Trace Metals, including Hg and As (except for Se--see below)	60 ml I-Chem 300-series clear glass jar with Teflon lid-liner; Pre-cleaned	60 ml (one jar)	Cool to 4°C, dark, up to 14 days	12 months(1) (-20°C)
Selenium (separate container required)	60 ml I-Chem 300-series clear glass jar with Teflon lid-liner; Pre-cleaned	60 ml (one jar)	Cool to 4°C, dark, up to 14 days	12 months(1) (-20°C)
Synthetic Organic Compounds	250 ml I-Chem 300-series amber glass jar with Teflon lid-liner; Pre-cleaned	500 ml (two jars)	Cool to 4°C, dark, up to 14 days	12 months(1) (-20°C)
Sediment TOC	125 ml(3) clear glass jar; Pre-cleaned	125 ml (one jar)	Cool to 4°C, dark, up to 28 days	12 months(2) (-20°C)
Sediment Grain Size	125 ml(3) clear glass jar; Pre-cleaned	125 ml (one jar)	Cool to 4°C, dark, up to 28 days	28 days (4°C) ***Do not freeze***
Sediment Toxicity Testing	1-Liter I-Chem wide-mouth polyethylene jar with Teflon lid-liner; Pre-cleaned	2-Liters (two jars filled completely)	Cool to 4°C, dark, up to 14 days	14 days (4°C) ***Do not freeze***

(1) Sediment samples for parameters noted with one asterisk (*) may be refrigerated at 4°C for up to 14-days maximum, but analysis must start within the 14-day period, or the sediment sample must be stored frozen at minus (-) 20°C for up to 12 months maximum.

(2) Sediment samples for sediment TOC analysis can be held at 4°C for up to 28 days, and should be analyzed within this 28 day period, but can be frozen at any time during the initial 28 days, for up to 12 months maximum at minus (-) 20°C.

(3) Sediment samples for TOC AND grain size analysis can be combined in one 250 ml clear glass jar, and sub-sampled at the laboratory in order to utilize holding time differences for the two analyses. If this is done, the 250 ml combined sediment sample must be refrigerated only (not frozen) at 4°C for up to 28 days, during which time the sub-samples must be aliquoted in order to comply with separate storage requirements (as shown above).